SERVICE MANUAL

Bair Hugger* Series 200 and 500 Warming Units

Augustine Medical

Bright ideas…that work

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Worldwide Technical Service and Order Placement

United States, Puerto Rico, Canada, Worldwide

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In-Warranty Repair and Exchange

Replacement parts to correct a problem are delivered at no charge. To return a device to Augustine Medical, Inc. for service, first obtain a Return Authorization (RA) number from a technical service representative. Please use this number on all correspondence when returning a device for service. A shipping carton will be delivered to you at no charge, if needed. We will service and ship your device within five (5) working days of our receipt. Call your local supplier or sales representative to inquire about loaner devices while your device is being serviced.

When You Call for Technical Service

Remember, we will need to know the serial number of your Unit when you call us.

Total Temperature Management System

The Bair Hugger brand Total Temperature Management System was developed by an anesthesiologist to prevent and/or treat the common but significant problem of hypothermia.

Examples of current applications for Bair Hugger systems are post anesthesia care units (PACU), recovery rooms, operating rooms, emergency departments, obstetrical suites, and intensive care areas.

The warming unit draws ambient air through a filter and warms the air to the specified temperature. It then delivers the warmed air through a hose to the Bair Hugger blanket over the patient.

When used properly, the Bair Hugger blanket distributes the warm air around the patient's body, creating a warm environment.

This manual describes how to service Bair Hugger warming units, and includes maintenance instructions and specifications. Instructions for use can be found in the Operation Manual, and instructions included with Bair Hugger blankets and 21 fluid warming sets.

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Precautionary Information

Contraindications

Temperature

Do not apply heat to lower extremities during aortic cross-clamping. Thermal injury may occur if heat is applied to ischemic limbs.

200 Series Units

Do not use 200 Series warming units in operating rooms. Thermal injury and airborne contamination may result.

Warnings

200 Series Units

Do not use the HIGH temperature setting on 200 Series warming units when treating patients with the following conditions:

- Significant peripheral vascular disease (occlusive or diabetic)
- Low cardiac output
- Total immobilization
- Marginal cutaneous perfusion

Monitor the patient's temperature at least every 10 to 20 minutes. Risk of thermal injury is significant for this group of patients.

Bair Hugger Therapy

Do not use Bair Hugger warming units with any forced-air blanket or cover other than Bair Hugger blankets. Thermal injury may result.

Do not use any fluid administration device other than the 241 fluid warming set with the Bair Hugger warming unit. Fluid temperature outside the indicated range may result.

Do not warm patients with the warming unit hose alone. Thermal injury may result. Always attach the hose to a Bair Hugger blanket before providing skin surface warming therapy.

Do not use the 241 fluid warming set with any other forced air warming system other than the 500 Series Bair Hugger system. Fluid temperature outside the indicated range may result.

Alarm

Do not continue therapy if the Over Heat Warning light illuminates and the audible alarm sounds. Thermal injury may result. Turn the warming unit off and contact qualified service personnel. If using the 241 fluid warming set, immediately stop fluid flow, and discard the fluid warming set.

Precautions

Monitor Temperature

Monitor the patient's temperature at least every 10-20 minutes, and monitor patient vital signs regularly. Reduce air temperature or discontinue therapy when the therapeutic goal is reached or if vital sign instability occurs. Notify physician immediately of vital sign instability.

Pediatric Use

To prevent suffocation from misuse, do not leave children or infants unattended when administering Bair Hugger therapy.

Sterility

Except for specific blanket models, Bair Hugger blankets are not sterile. All Bair Hugger blankets are intended for single patient use only. Placing a sheet between the Bair Hugger blanket and the patient does not prevent contamination of this product.

Patient Safety

Series 500 and 600 blankets meet an international standard for flammability, IEC 695-2-2, and the Consumer Product Safety Commission's flammable fabric regulation, 16 CFR 1610; however, follow standard safety protocols when using high intensity heat sources.

Visual Distortion

The blanket's clear plastic drape may cause visual distortion. Lift the plastic drape to view the patient's head clearly.

Read Instructions

See CONTRAINDICATIONS and WARNINGS before administering therapy. Read the Operation Manual, blanket instructions and fluid warming package instructions before use.

Important Information

Explosion Hazard

Do not use in the presence of flammable anesthetics.

Electrical Shock Hazard

Do not disassemble the warming unit; refer to an authorized service technician. There are electrically live parts within the warming unit when it is connected to the power source, even when the switches are in the OFF or STANDBY position.

Electrical Interference

If radio frequency interference with monitoring equipment should occur, connect the warming unit to a different power source.

Read Before Servicing Equipment

The repair, calibration, and servicing of the warming unit requires the skill of a qualified Medical Equipment Service Technician who is familiar with good practice for medical device repair. If service is designated as not requiring manufacturer's attention, the technical information is provided in this Service Manual or will be provided, on request, by Augustine Medical, Inc.

Refer to Service Manual

Perform all repairs and maintenance in accordance with the instructions in this Service Manual.

Safety Inspection

Perform a safety inspection after making repairs to the Bair Hugger warming unit, and before returning the warming unit to service. A safety inspection should include a test of the operating temperatures (described in this Service Manual), the Over Heat Alarm system, as well as a leakage current test.

Proper Use and Maintenance

Augustine Medical, Inc. assumes no responsibility for the reliability, performance, or safety of the equipment if:

- Modifications or repairs are performed by non-authorized personnel.
- The equipment is used in a manner other than that described in the Operation or Service Manuals.
- The equipment is installed in an environment that does not meet the relevant grounding requirements.

Model 200 Series Warming Units

Cabinet Cleaning

Tools/Equipment

Soft cloth, lightly dampened with water and mild detergent.

Method

1. Disconnect the warming unit from the power source.
2. Wipe the exterior of the warming unit clean.

CAUTION: *Do not use a dripping wet cloth when cleaning the warming unit. Moisture may seep into the electrical contacts and damage the components. Do not use alcohol or other solvents to clean the cabinet. Solvents may damage the labels and other plastic parts.*

Hose Replacement

Tools/Equipment

Phillips-head screwdriver

Method

1. Remove the Phillips-head hose anchor screw at the blower outlet (see Figure 2).
2. Pull the old hose off the blower outlet flange.
3. Insert the new hose into the blower outlet flange.

NOTE: *There are a number of variations of hoses (Figure 1) to provide for specific therapeutic needs. These various hose options (e.g., non-swivel end, swivel end, extended length) are not interchangeable. If the hose were to be mated improperly, there would be an obvious fit problem. Do not force a hose into a fitting, use adapters, or modify the hose ends. Use of a wrong hose could result in temperatures outside of the indicated range.*

4. Secure the Phillips-head hose anchor screw. The screw is self-tapping into the hose end.
5. Record the maintenance action taken.

Figure 1. Hose Options

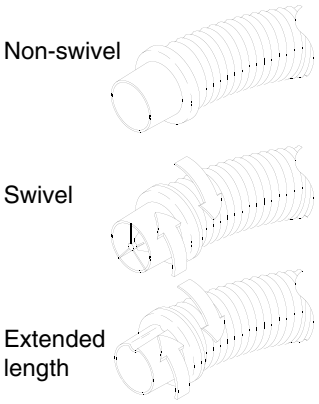
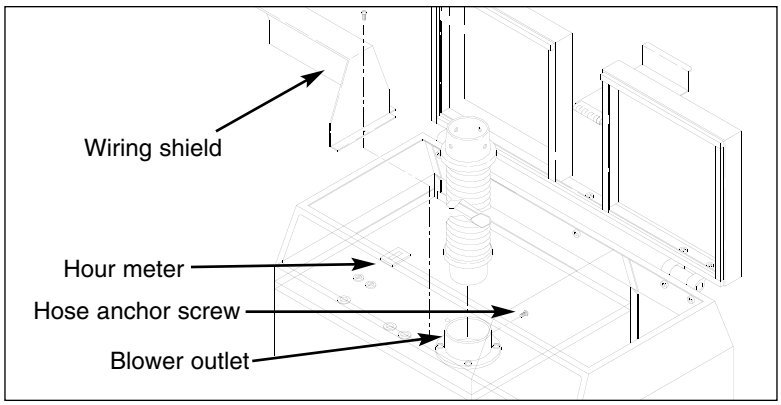


Figure 2. Location of Hose Anchor Screw.



Power Fuse Replacement

Tools/Equipment

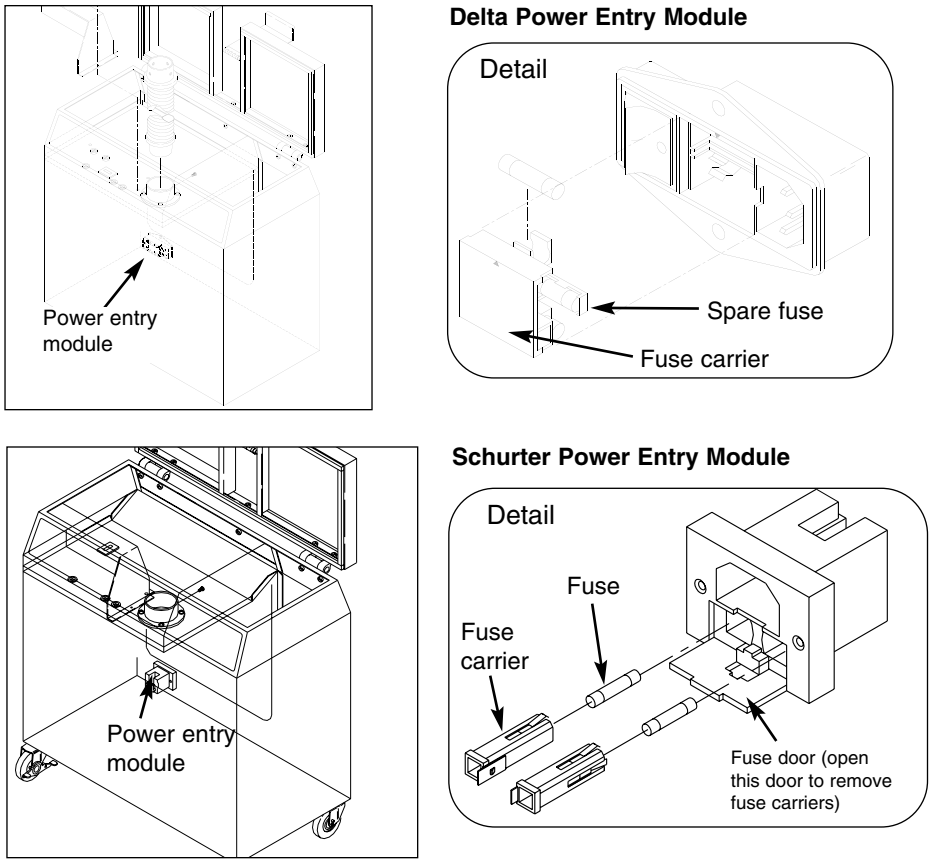
- Phillips-head screwdriver
- Small slotted screwdriver

Accessing the Power Fuses

1. Disconnect the warming unit from the power source.
2. Access the fuse. See Figures 3 and 4 for location of fuses in 200 series units.

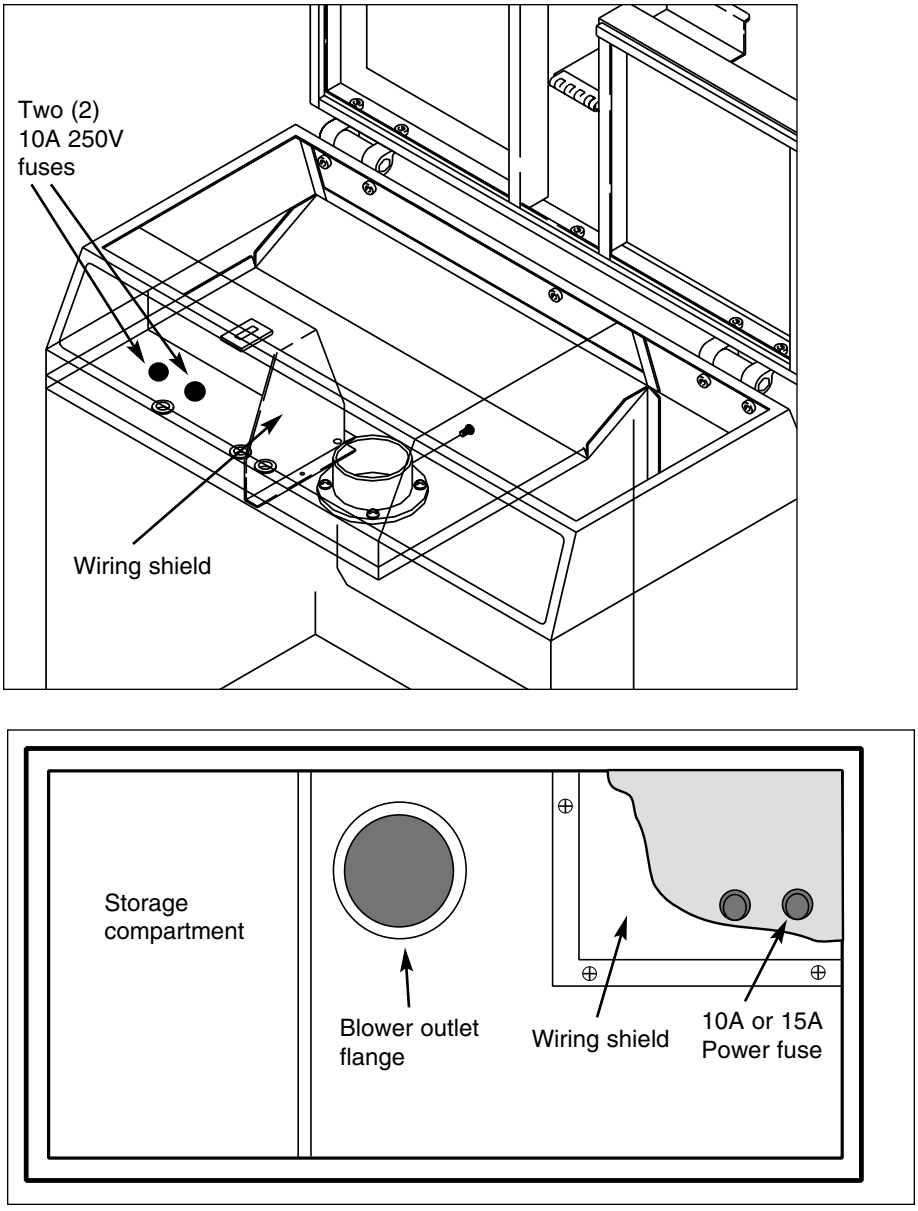
CAUTION: *Replace only with the fuse capacity and type that is indicated.*

Figure 3. Locating the Power Fuses in Models with Power Entry Modules



3. To access the fuse, remove the two (2) Phillips-head screws that secure the cord retainer. Remove the power cord.
4. Use the small screwdriver to remove the fuse carrier.
5. Remove the blown fuse(s) and replace with the new ones.
6. Replace the fuse carrier.
7. Reattach the power cord and the two (2) Phillips head screws that secure the cord retainer.

Figure 4. Locating the Power Fuses in Models with No Power Entry Module



1. To replace the fuse, remove the wiring shield by unscrewing the three Phillips screws.
2. Unscrew the fuse holder cap, remove the old fuse, and insert the new fuse.
3. Reattach the wiring shield.

After replacing the fuses, reconnect the warming unit to the power source and record the maintenance action taken.

Control Board Fuse Replacement

Tools/Equipment

Phillips-head screwdriver

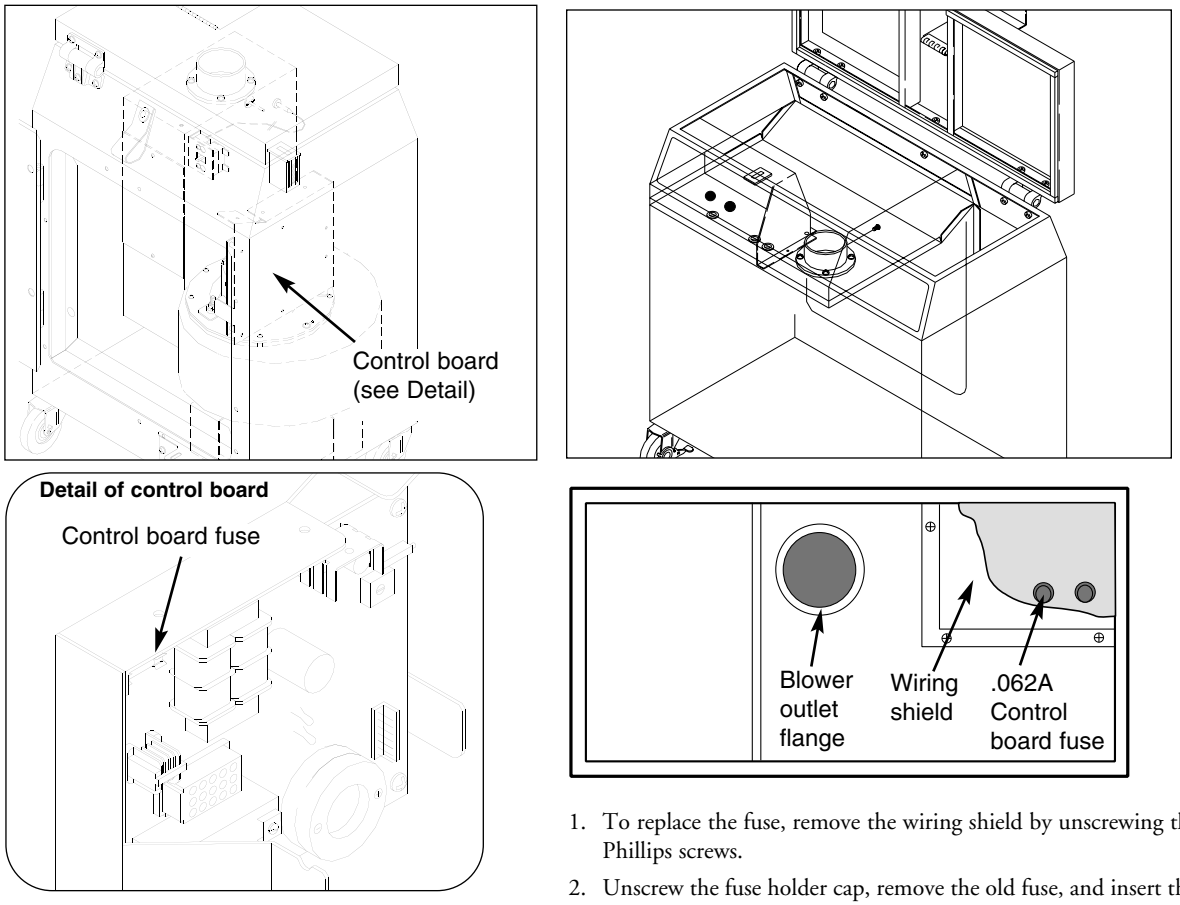
Method

1. Disconnect the warming unit from the power source.
2. Remove the four (4) Phillips-head screws on the rear access panel.
3. Open the rear access panel and remove the filter.
4. Locate the fuse (see Figure 5) and replace as specified.

CAUTION: *Replace only with the fuse capacity and type that is indicated.*

5. Put the filter back into place and close the rear access panel.
6. Replace the four (4) Phillips-head screws on the rear access panel.
7. Reconnect the warming unit to the power source.
8. Record the maintenance action taken.

Figure 5. Location of Control Board Fuses in 200 Series Units



1. To replace the fuse, remove the wiring shield by unscrewing the three Phillips screws.
2. Unscrew the fuse holder cap, remove the old fuse, and insert the new fuse.
3. Reattach the wiring shield.

Air Filter Replacement

The air filter is mounted inside the rear access panel.

Service Frequency

Six-month intervals, or 500 hours of use

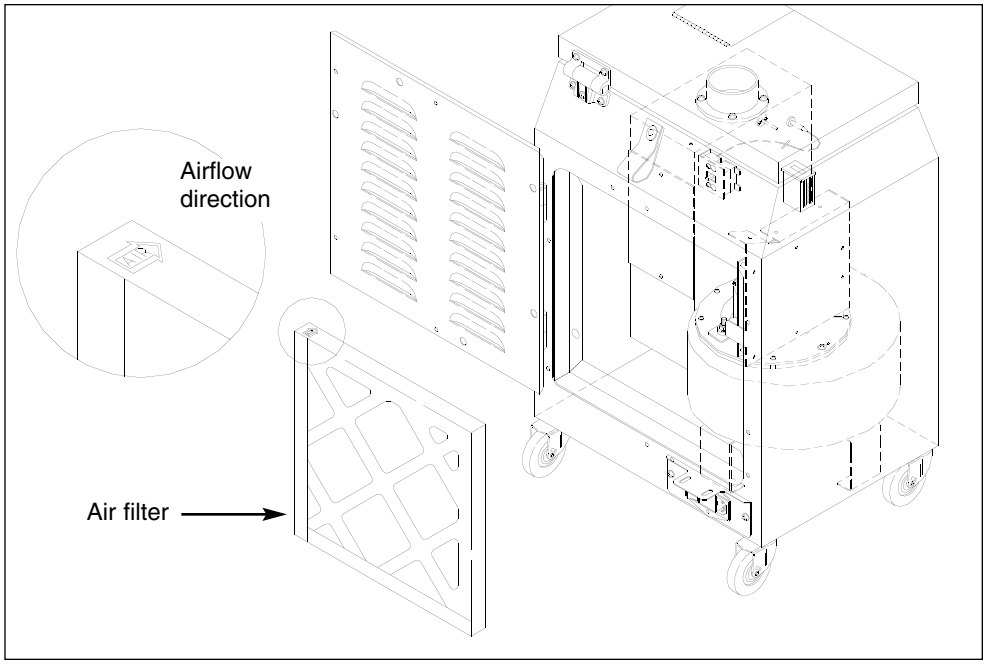
Tools/Equipment

Phillips-head screwdriver

Method

1. Disconnect the warming unit from the power source.
2. Remove the four (4) Phillips-head screws on the rear access panel. Open the panel.
3. Lift out the old filter and read the hour meter, if applicable.
4. Record the meter reading and date on the new air filter label.
5. Insert the new filter in the filter frame (see Figure 6). The airflow arrow should point into the warming unit.
6. Close the rear access panel and resecure the four (4) Phillips-head screws.
7. Reconnect the warming unit to the power source.
8. Record the maintenance action taken.

Figure 6. Location of Air Filter



Over Heat Alarm Testing

WARNING: *Perform all testing and adjustments of warming unit temperature with a calibrated Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit. Augustine Medical, Inc. assumes no responsibility for the reliability, safety, or performance of the Bair Hugger system if warming unit temperature testing or adjustments are made in any other manner than that described here. Improper measurement or adjustment of the warming unit's over heat alarm setting could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

NOTE: *The Model 221 Temperature Test Kit and the Model 22110 Temperature Test Unit are designed to simulate the operating characteristics of Bair Hugger blankets when used with Bair Hugger warming units; use of the temperature test device with any other warming system may result in imprecise readings.*

If using the Model 221 Test Kit, temperature readings are taken from the test kit itself. If using the Model 22110 Test Unit, temperature readings are taken from a calibrated temperature meter.

NOTE: *Some Model 200 warming units will not reset automatically. If your unit has a manual reset, please call Augustine Medical Customer Service for special instructions or a replacement unit.*

Service Frequency

Six-month intervals, or 500 hours of use

Tools/Equipment

- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit
- Phillips-head screwdriver
- Short jumper wire with alligator clips or needlenose pliers.

If using the Model 22110 Temperature Test Unit:

- Use a calibrated temperature meter that can accept a male subminiature connector for a K style thermocouple (e.g., a Fluke Model 52 K/J Thermometer).
- If the connector does not fit your meter, you can remove the provided connector and attach a connector that fits your meter.

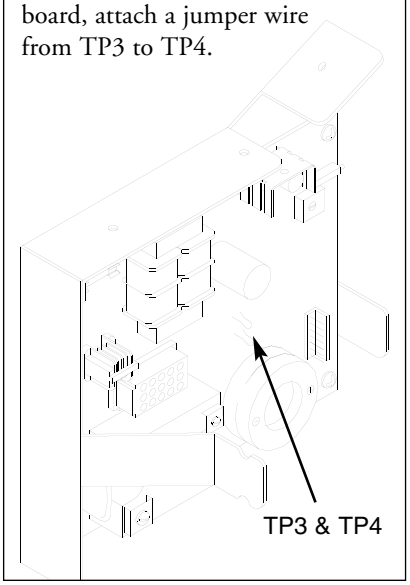
Accessing the Control Board

1. Disconnect the warming unit from the power source.
2. Remove the four (4) Phillips-head screws on the rear access panel. Open the access panel.
3. Remove the filter to access the control board.

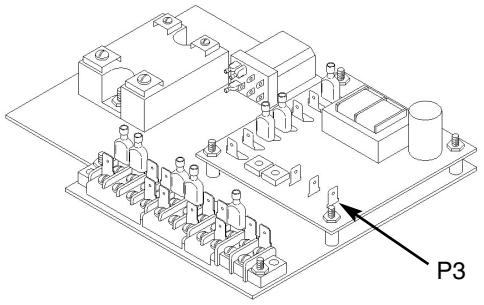
1. Prepare the control board as shown below.

Figure 7. Control Boards for 200 Series Units

Units with the Watlow A007 control board: On the control board, attach a jumper wire from TP3 to TP4.



Units with the Series 80 control board: Pull the blue lead from P3.



2. Reconnect the warming unit to the power source.

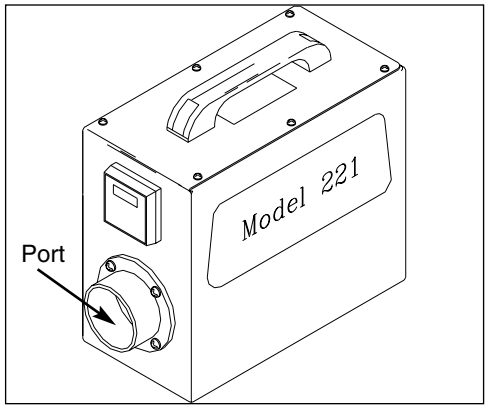
Electrical shock hazard. *Dangerous voltages are now present on the control board. Please use caution.*

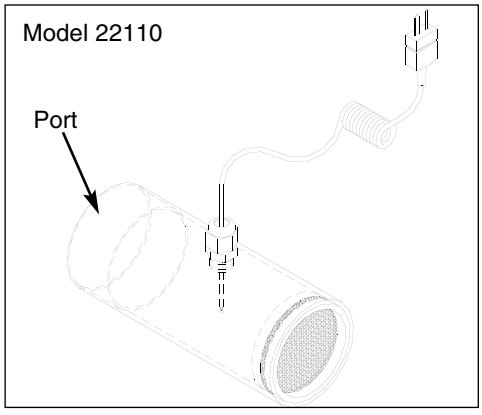
3. Insert the open hose end from the warming unit in the port on the temperature test device (see Figure 8). Turn the warming unit power ON.

NOTE:

- *Do not block the rear air vents on the test device.*
- *The temperature setting will not affect the over heat test because the control circuit has been bypassed.*

Figure 8. Temperature Test Devices





4. The over heat condition activates both visual and audible alarms. The warming unit will remain in an alarm condition until the temperature drops sufficiently to deactivate the thermostat. The alarm and reset constitutes one cycle.
5. Allow the warming unit to cycle to alarm twice more.
6. When the alarm activates, note the alarm temperature read-out on the temperature test device (see Table 1 for specified limits).

   NOTE: *The first over heat cycle may be slightly higher when started from a cold start.*
7. If the results of the test did not meet the specified limit, adjust the over heat thermostat. See the *Over Heat Alarm Thermostat Adjustment* section.
8. If the results of the test did meet the specified limit, turn the warming unit power OFF and disconnect the warming unit from the power source.
9. Remove the hose from the port on the temperature test device.
10. Remove the jumper wire from TP3 and TP4, (or reattach the blue lead to P3, if applicable). See Figure 7.
11. Put the filter back into place, close the rear access panel, and resecure the Phillips-head screws.
12. Reconnect the warming unit to the power source.
13. Record the maintenance action taken.

Table 1. Over Heat Specification

Model 200 Series (Except Model 275) High Temperature Thermostat

The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 56° ± 3°C (132.8° ± 5.4° F), or less, at the end of the hose, as determined by the Augustine Medical temperature test device.

Model 275 High Temperature Thermostat

The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 53° ± 3°C (127.4° ± 5.4°F), or less, at the end of a hose, as determined by the Augustine Medical temperature test device.

Over Heat Alarm Thermostat Adjustment

WARNING: *Improper adjustment of the warming unit's over heat alarm setpoint could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

- *Dangerous voltages are present at the terminals of the thermostat.*
- *Always use a Model 221 Temperature Test Kit or the 22110 Temperature Test Unit to verify output temperatures.*
- *Recalibrate the Temperature Test Kit at least once a year. The Model 22110 Temperature Test Unit does not need to be calibrated. The meter it is connected to must be calibrated. Follow the calibration instructions in the meter service manual or follow standard facility calibration schedules.*
- *When in doubt, contact Augustine Medical Customer Service for assistance in temperature adjustment.*

Tools/Equipment

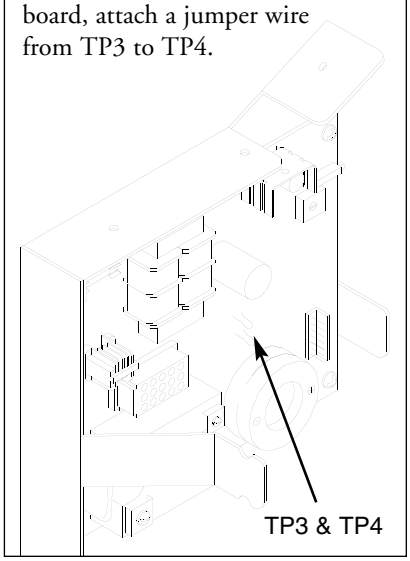
- Small slotted screwdriver
- Phillips-head screwdriver
- Short jumper wire with alligator clips or needlenose pliers
- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit

Accessing and Preparing the Control Board

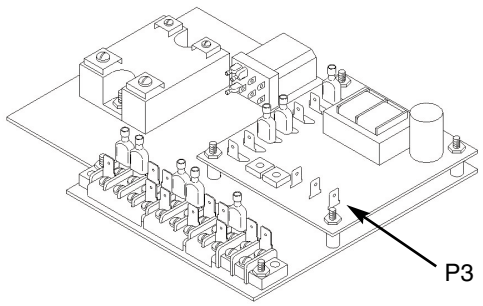
1. Disconnect the warming unit from the power source.
2. Remove the four (4) Phillips-head screws on the rear access panel. Open the access panel.
3. Remove the filter to access the control board.
4. Prepare the control board before adjusting the thermostat. See Figure 9.

Figure 9. Control Boards for 200 Series Units

Units with the Watlow A007 control board: On the control board, attach a jumper wire from TP3 to TP4.

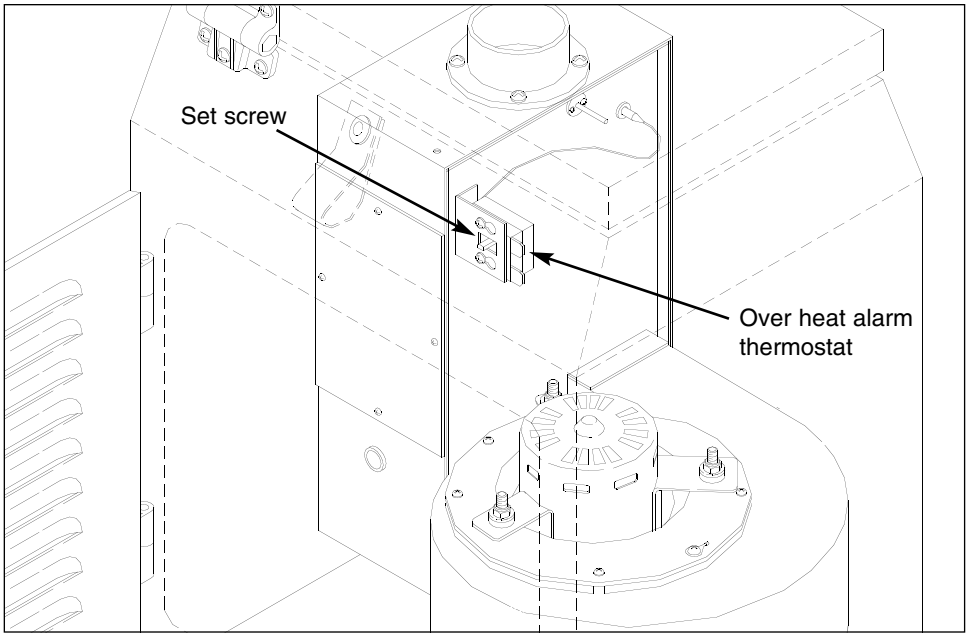


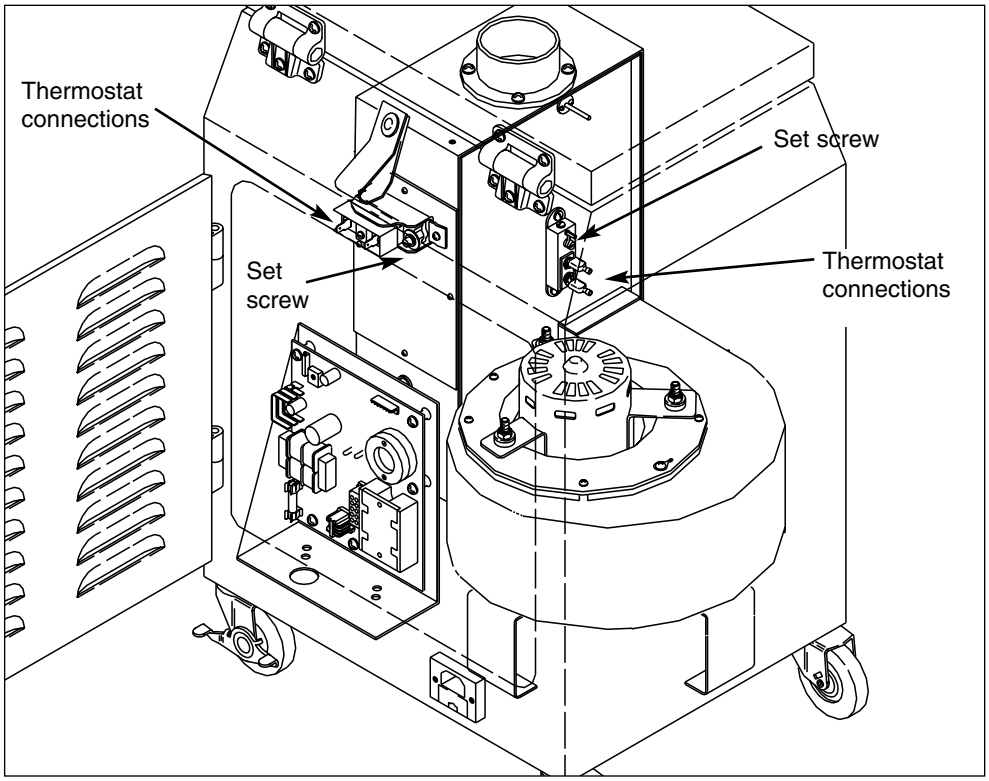
Units with the Series 80 control board: Pull the blue lead from P3. This will override the temperature control and send the unit into an overtemperature condition.



5. Find the over heat alarm thermostat (see Figure 10).

Figure 10. Locating the Thermostat





Adjusting the Over Heat Alarm Thermostat

1. Reconnect the warming unit to the power source and turn the warming unit power ON.

Electrical shock hazard. *Dangerous voltages are present on the control board. Please use caution.*

NOTE:

- *The temperature setting will not affect the over heat adjustment and subsequent testing because the control circuit has been bypassed.*
- *Adjustment of the over heat alarm thermostat is most easily done while the temperature read-out on the temperature test device is climbing.*

2. Insert the open hose end from the warming unit into the port on the temperature test device.

   NOTE: *Do not block the rear air vents on the test device.*

3. Use a small slotted screwdriver to adjust the thermostat.
   - If the tested alarm temperature was below specified limits, turn the screwdriver CLOCKWISE to increase the alarm temperature.
   - If the tested alarm temperature was above specified limits, turn the screwdriver COUNTERCLOCKWISE to lower the alarm temperature.
4. Fine-tune the adjustment until the warming unit alarms at the specified temperature.
5. Retest the over heat alarm at least twice to verify correct adjustment.
6. When the warming unit alarm setting is within the specified limit, turn the warming unit OFF, and disconnect the warming unit from the power source.
7. Remove the hose end from the temperature test device.
8. Remove the jumper from test points TP3 and TP4, (or reattach the blue lead to P3, if applicable).
9. Put the filter back into place and close the rear access panel.
10. Replace the four (4) Phillips-head screws on the rear access panel.
11. Record the maintenance action taken.

Normal Operating Temperature Testing

WARNING: *Perform all testing and adjustments of warming unit temperature with a calibrated Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit. Augustine Medical, Inc. assumes no responsibility for the reliability, safety, or performance of the Bair Hugger system if warming unit temperature testing or adjustments are made in any other manner than that described here. Improper measurement or adjustment of the warming unit's normal operating temperature could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

Service Frequency

Six-month intervals, or 500 hours of use

Tools/Equipment

Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit.

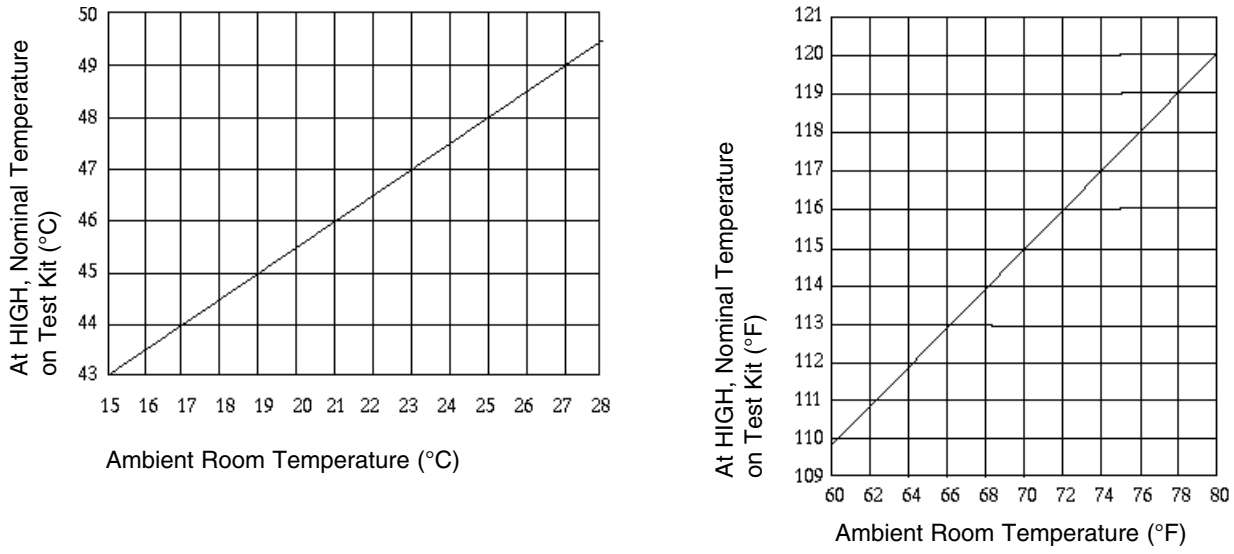
Method

1. Insert the open hose end from the warming unit in the port on the temperature test device (see Figure 8).

   NOTE: *Do not block the rear air vents on the test kit.*

2. Turn the warming unit power ON and select the HIGH temperature setting. Always begin testing with the HIGH setting.
3. Note the ambient room temperature.
4. After approximately five (5) minutes of operation, note the temperature read-out. Use Figure 11 to correlate ambient temperature to the warming unit's operating temperature.

Figure 11. Room Temperature v.s. High Temperature Output
Warming Unit Temperature Setting Should Be on HIGH When Conducting This Test



5. After correcting for ambient temperature, the tested normal operating temperature should meet the limits specified in Table 2.
6. If the HIGH temperature setting is not within specified limits, adjust the normal operating temperature. See the Normal Operating Temperature Adjustment section.

Table 2.
Model 200 Series Operating Temperatures

(Operating temperatures= Average temperature at the end of the hose.)

Model	Operating Temperatures		
200 Series	HIGH:	46°± 3°C	114.8° ± 5.4°F
(Except 275)	MED:	41°± 3°C	105.8° ± 5.4°F
	LOW:	37°± 3°C	98.6° ± 5.4°F
275	HIGH:	43°±3°C	109.4° ± 5.4°F
	MED:	38°±3°C	100.4° ± 5.4°F
	LOW:	32°±3°C	89.6° ± 5.4°F

Note: Air temperature reaching the patient is approximately 2°C lower than the temperatures listed.

7. If the HIGH temperature setting is within specified limits, verify the MED, and then LOW settings against specified limits (allow the warming unit to operate at each temperature setting for about three (3) to five (5) minutes before each test).
8. Turn the warming unit OFF. Remove the hose end from the port on the temperature test device.
9. Record the maintenance action taken.

Normal Operating Temperature Adjustment

WARNING: *Improper adjustment of the warming unit's normal operating temperature could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

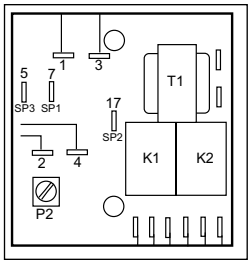
- *Always use a Model 221 Temperature Test Kit or a Model 22110 Termperature Test Unit to verify operating temperatures.*
- *Always make adjustments relative to the HIGH temperature setting on the warming unit. When the HIGH setting is accurately adjusted, the MED and LOW settings should also be within specified limits. If the HIGH range is properly set, and MED and/or LOW do not meet specs, call Technical Service.*
- *Recalibrate the Temperature Test Kit at least once per year.*
- *When in doubt, contact Augustine Medical Customer Service for assistance in temperature adjustment.*

Tools/Equipment

- Phillips-head screwdriver
- Small slotted screwdriver
- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit

Method

NOTE: *If your unit contains the control board pictured here, no temperature adjustments can be made. Contact Augustine Medical Customer Service.*

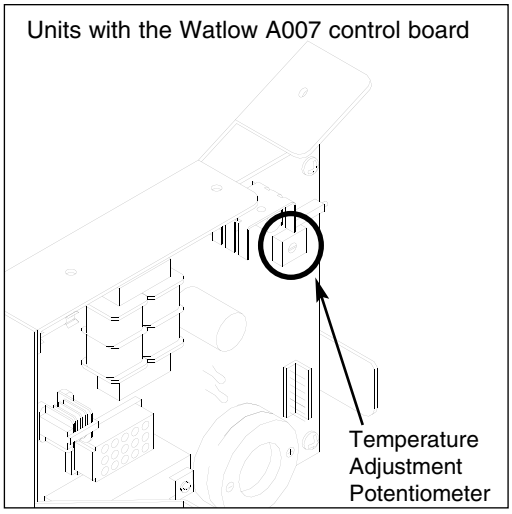


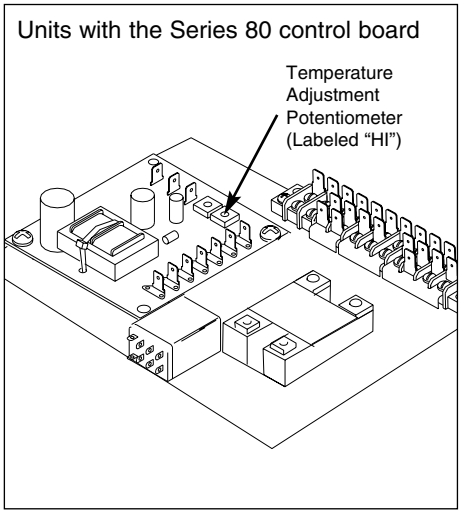
Electrical shock hazard. *Dangerous voltages are present on the control board. Please use caution.*

1. Remove the four (4) Phillips-head screws on the rear access panel.
2. Open the rear access panel and remove the filter.
3. Find the temperature adjustment potentiometer located on the warming unit's control board (see Figure 12).

Figure 12. Location of Temperature Adjustment Potentiometer

WARNING: *Use the "HI" temperature adjustment potentiometer only. If temperature is still out of range, please call Technical Service.*





4. Insert the open hose end from the warming unit into the port on the temperature test device.

   NOTE: *Do not block the rear air vents on the test device.*

5. Turn the warming unit power ON, and select the HIGH temperature setting. Always make adjustments relative to the HIGH setting.

6. After approximately five (5) minutes of operation, adjust the potentiometer.

   NOTE: *In certain units you will need to remove the seal on the potentiometer. Make sure the unit is turned OFF before breaking the seal.*

   - Insert a small slotted screwdriver into the slot on top of the potentiometer.
   - If the tested operating temperature was below specified limits, turn the screwdriver CLOCKWISE to increase the operating temperature.
   - If the tested operating temperature was above specified limits, turn the screwdriver COUNTERCLOCKWISE to lower the operating temperature.

7. Adjust the potentiometer until the read-out meets the limits specified in Table 2 for the HIGH temperature setting (correlated to ambient temperature as in Figure 11).

8. Verify that the MED and LOW temperature settings are also within specified limits. If the HIGH range is properly set, and MED and/or LOW do not meet specs, call Augustine Medical Technical Service.

9. Turn the warming unit power OFF, and remove the hose from the port on the temperature test device.

10. Disconnect the warming unit from the power source.

11. Put the filter back into place and close the rear access panel.

12. Replace the four (4) Phillips-head screws on the rear access panel.

13. Record the maintenance action taken.

Specifications

Physical Characteristics

Model 200

Dimensions 26 in. high x 12 in. deep x 22 in. wide; 66 cm high x 30 cm deep x 56 cm wide

Weight 70 lb; 31.8 kg

Models 250/PACU, 275

Dimensions 26 in. high x 12 in. deep x 16 in. wide; 66 cm high x 30 cm deep x 41 cm wide

Weight 65 lb; 29.5 kg

Safety System

Thermostat

Bulb and capillary type or bi-metallic type

Over Heat Warning

If the temperature gets too high, the Over Heat warning light on the front panel will illuminate and/or the alarm will sound. The heat will shut off and the blower will continue to run. For the Model 275, the blower will also shut off.

High Temperature Thermostat

200 Series (Except 275)

The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 56° ± 3°C, 132.8° ± 5.4°F, or less, at the end of the hose, as determined by an Augustine Medical, Inc. temperature test device.

Model 275

The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 53° ± 3°C, 127.4° ± 5.4°F, or less, at the end of the hose, as determined by an Augustine Medical, Inc. Model temperature test device.

Temperature Characteristics

Air temperatures reaching the patient are approximately 2°C lower than the listed temperatures.

Operating Temperatures

Average temperature at the end of the hose, assuming the back pressure of a Bair Hugger® warming blanket, or a Model 221 Temperature Test Kit.

200 Series (Except 275)

HIGH:	46° ± 3°C	114.8° ± 5.4°F
MED:	41° ± 3°C	105.8° ± 5.4°F
LOW:	37° ± 3°C	98.6° ± 5.4°F

Model 275

HIGH:	43° ± 3°C	109.4° ± 5.4°F
MED:	38° ± 3°C	100.4° ± 5.4°F
LOW:	32° ± 3°C	89.6° ± 5.4°F

Leakage Current

Meets hospital and regulatory standards for leakage current.

Motor

Fractional horsepower, single phase

Heater

An electric resistive heating element

Fuses

200/250:	10A and 63mA
200E/250E:	5A and 32mA
275:	5A and 32mA
200J/250J:	10A and 63mA

Device Ratings

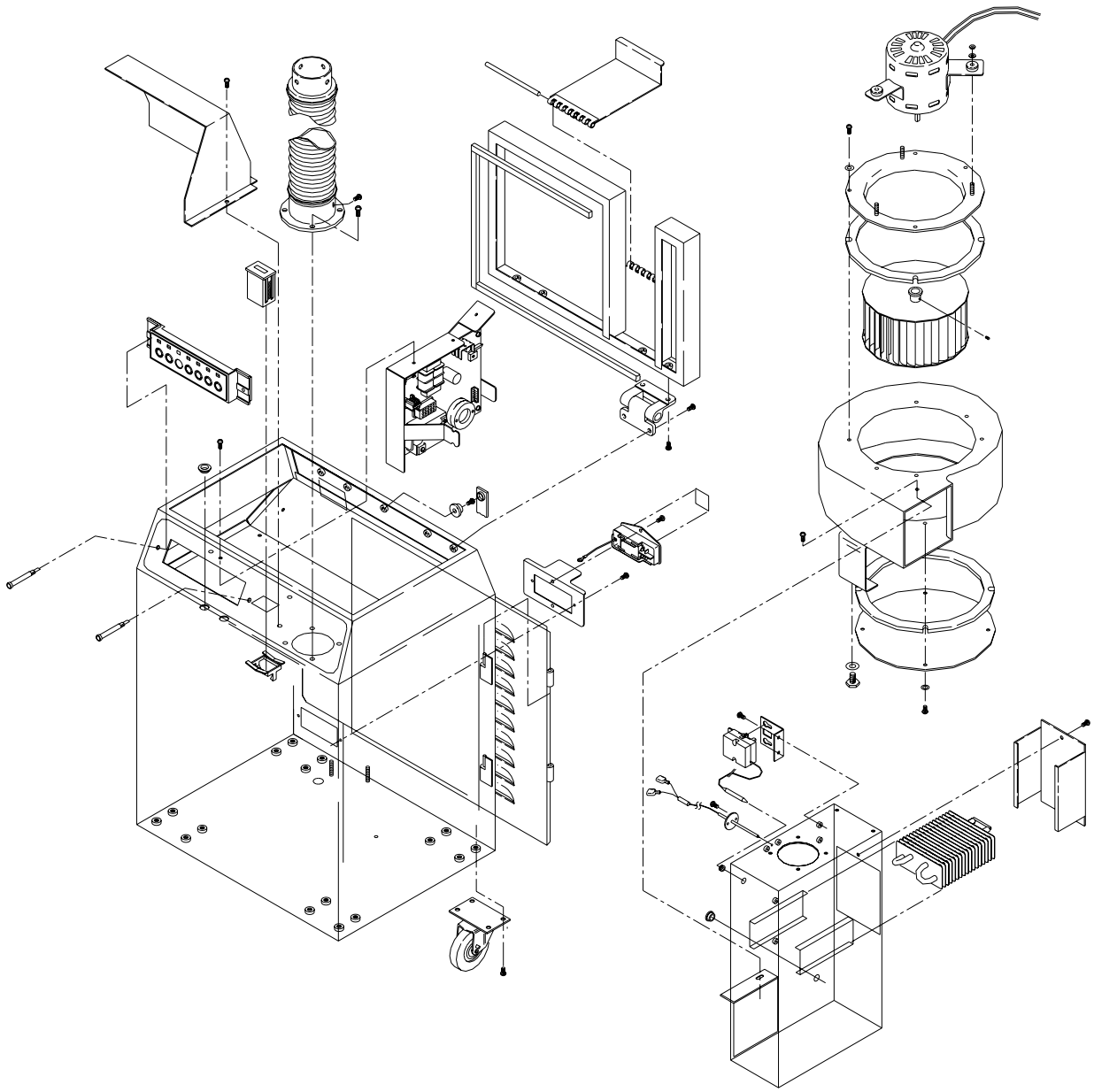
Model 200

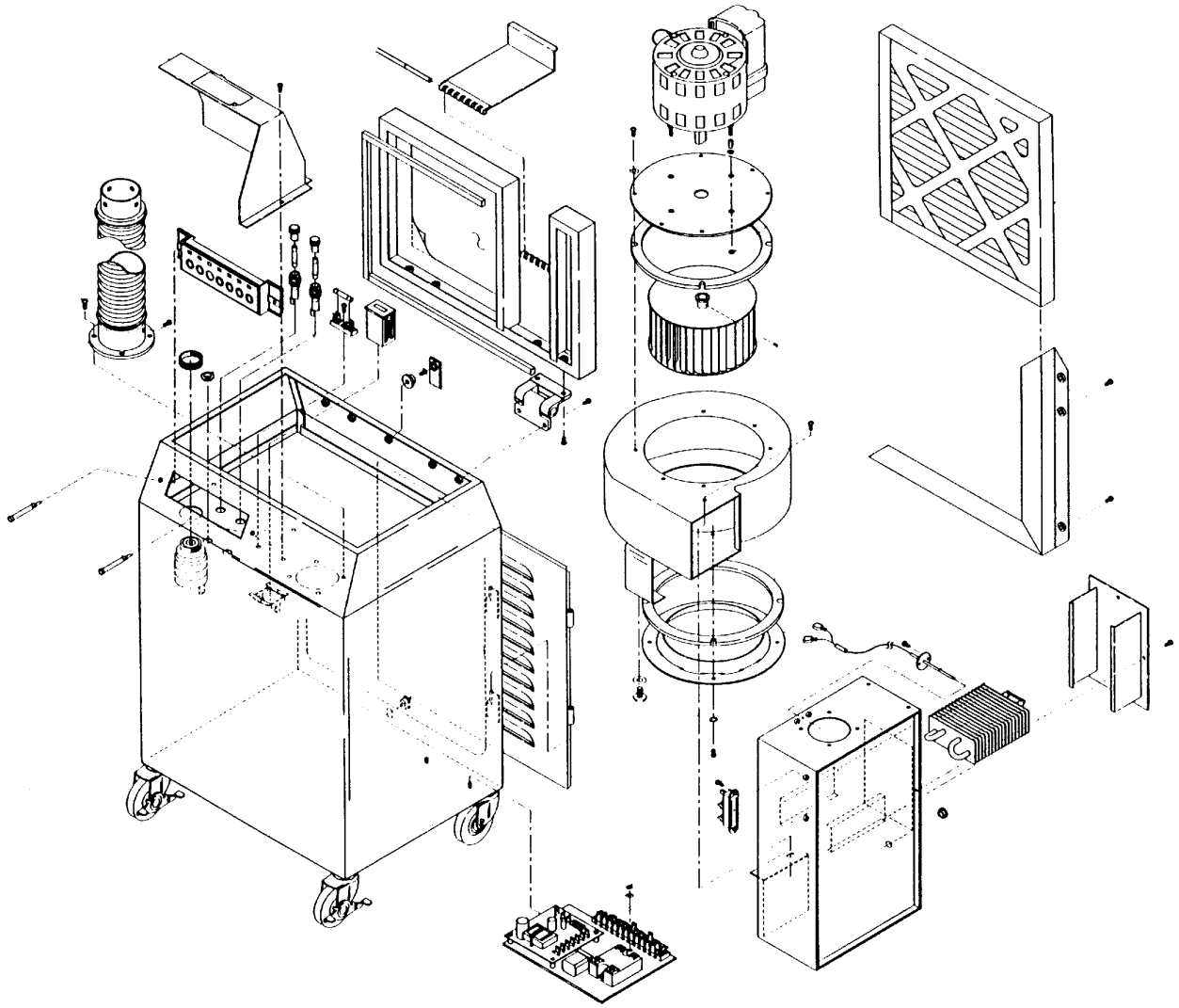
125VAC, 60Hz, 7 or 9.5 Amperes
240VAC, 50Hz, 4.5 Amperes
100VAC, 60Hz, 9.5 Amperes

Model 250

125VAC, 60Hz, 7 or 9.5 Amperes
220-240VAC, 50Hz, 4.5 Amperes (Model 275)
100VAC, 60Hz, 9.5 Amperes

Exploded Views of Model 200 and 250 Units





Cabinet Cleaning

Tools/Equipment

Soft cloth, *lightly* dampened with water and mild detergent

Method

1. Disconnect the Warming Unit from the power source.
2. Wipe the exterior of the Warming Unit clean.

CAUTION: *Do not use a dripping wet cloth when cleaning the Warming Unit. Moisture may seep into the electrical contacts and damage the components. Do not use alcohol or other solvents to clean the cabinet. Solvents may damage the labels and other plastic parts.*

Hose Replacement

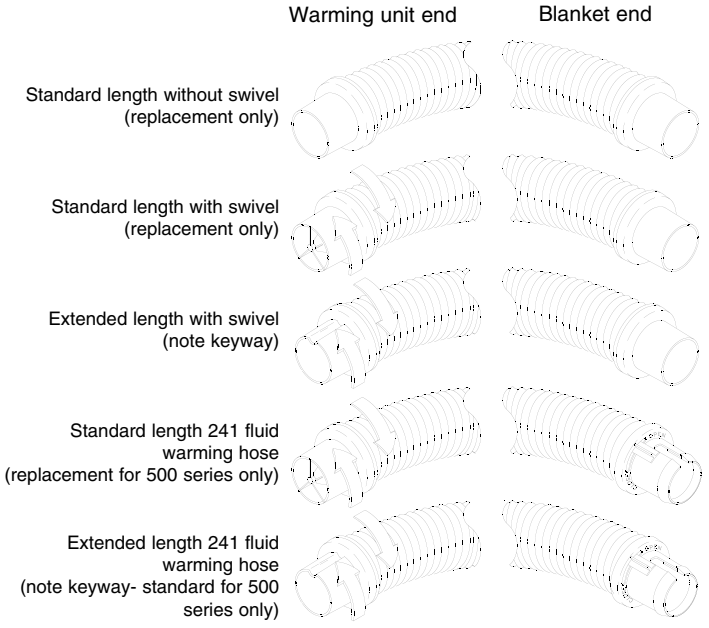
Method

1. Grasp the hose at the base and pull it free from the hose coupling flange.
2. Insert the new hose in the blower outlet flange.

   NOTE: *There are a number of variations of hoses (Figure 1) to provide for specific therapeutic needs. These various hose options are not interchangeable. If the hose were to be mated improperly, there would be an obvious fit problem. Do not force a hose into a fitting, use adapters, or modify the hose ends. Use of a wrong hose could result in temperatures outside of the indicated range.*

3. Record the maintenance action taken.

Figure 1. Hose Options



Power Fuse Replacement

Tools/Equipment

- Phillips-head screwdriver
- Small slotted screwdriver
- Needlenose pliers

Accessing the Fuses

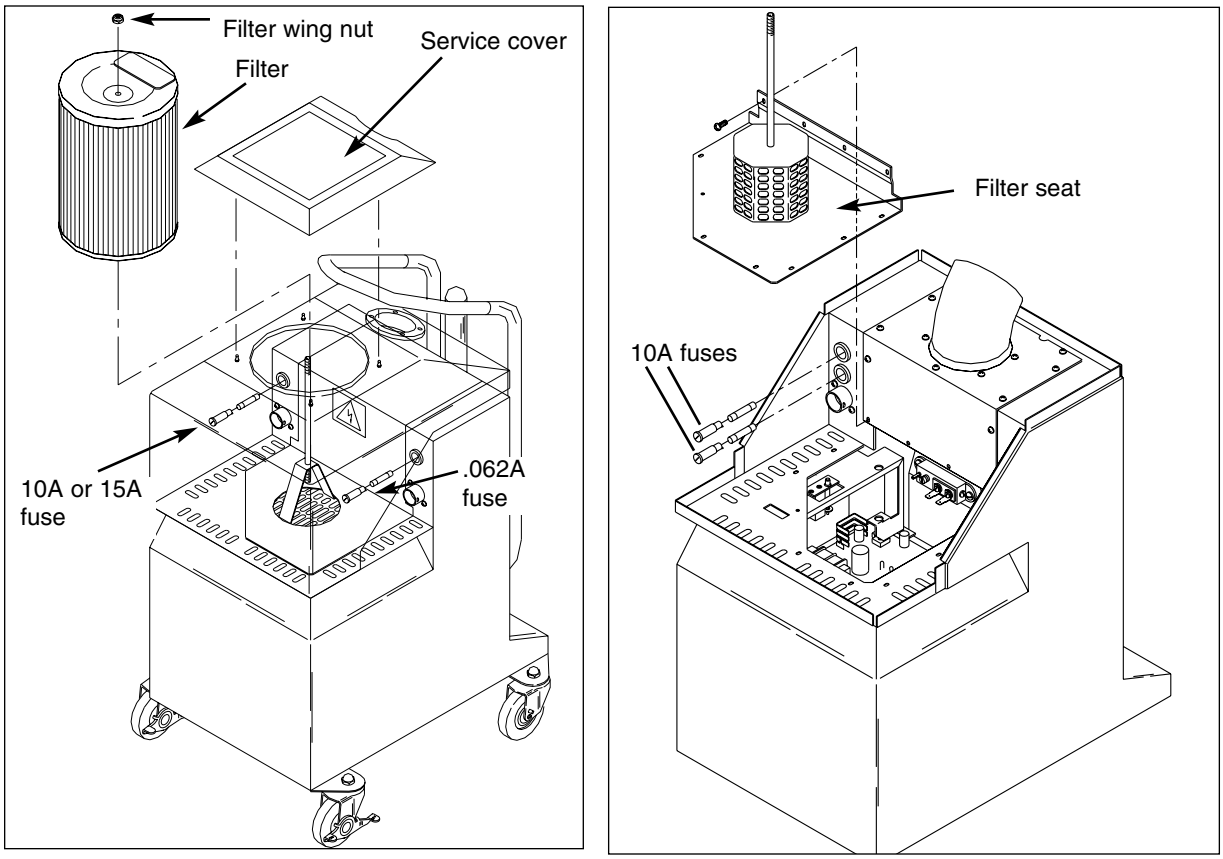
Before accessing the fuses, disconnect the warming unit from the power source.

Depending on which Model 500 Unit you have, there are different ways to access the power fuses (see Figures 2 and 3).

Accessing the Fuses in Units without a Power Entry Module

1. Remove the service cover by lifting it up. Remove the wing nut from the top of the filter.
2. Remove the filter.
3. Unscrew the fuse holder cap, remove the old fuse, and insert the new fuse.
4. Replace the fuse holder cap, filter, wing nut and service cover.

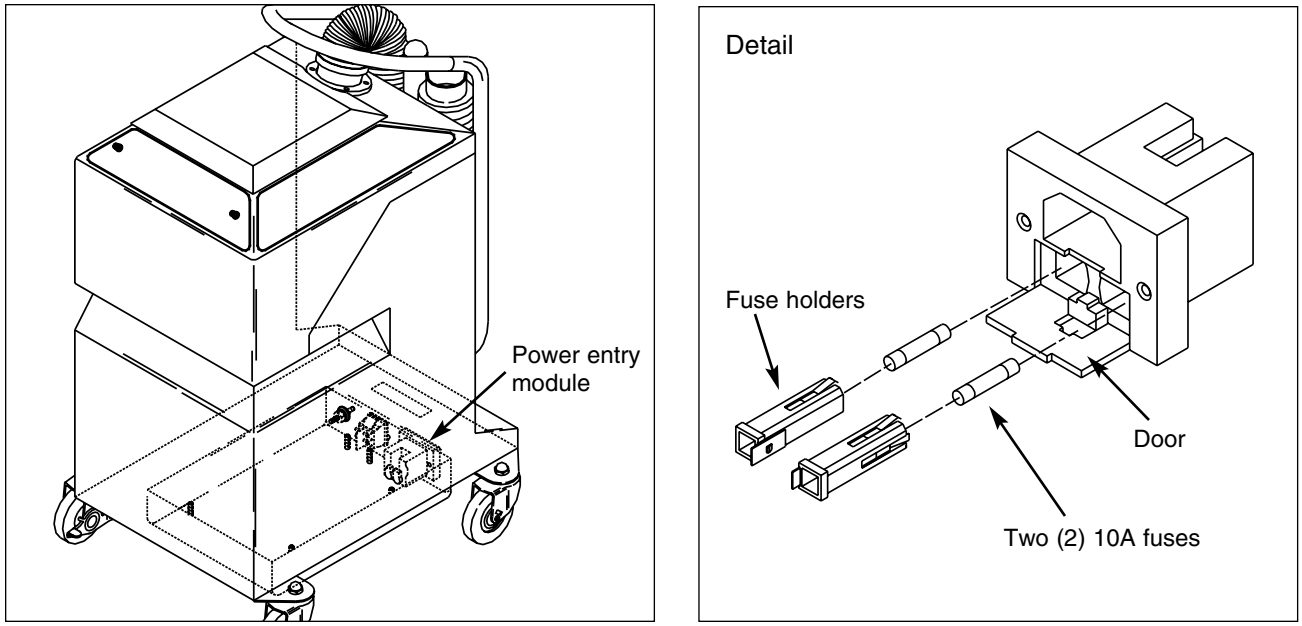
Figure 2. Accessing the fuses



Accessing the Fuses in Units with a Power Entry Module

1. Remove the cord retainer by removing the two (2) Phillips screws.
2. Remove the cord from the power entry module.
3. Depress the small latch to open the door to the power entry module. See Figure 3.
4. To remove the fuses, pinch the clip on the fuse holder and pull out the fuse holder with a needlenose pliers.
5. To reinstall, insert the fuse holder (with clip facing inward) and push in until it snaps.

Figure 3. Accessing the fuses in units with a power entry module



Seating the Filter

1. Make sure that the filter is seated firmly to fully engage the interlock switch. The unit will not run unless the interlock switch is properly seated.
2. Record the maintenance action taken.
3. Connect the warming unit to the power source and turn it on to verify that the filter interlock is properly seated.

Control Board Fuse Replacement

NOTE: *Depending on which Model 500 Unit you have, there are different ways to access the control board fuse. See Figures 4 and 5.*

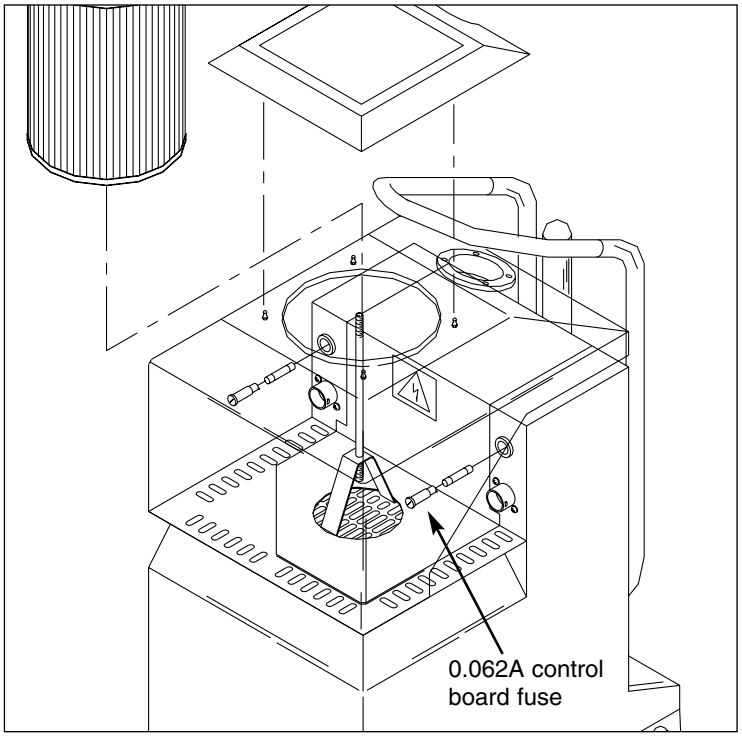
Tools/Equipment

Phillips-head screwdriver

Accessing the Control Board Fuse in Models with a Series 80 Control Board

1. Disconnect the Warming Unit from the power source.
2. Remove the service lid and filter from the unit.

Figure 4. Accessing the control board fuse



Replacing the Fuses

For slotted type fuse holders:

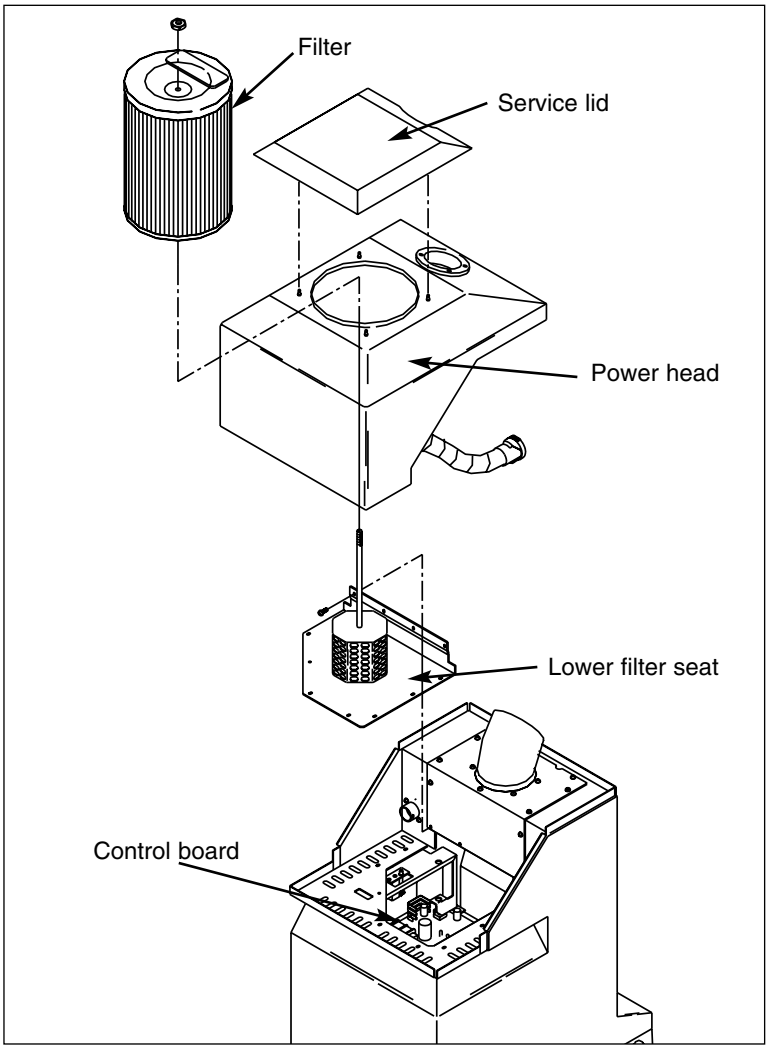
1. Using a small screwdriver, push the fuse holder in slightly and turn 90° counterclockwise.
2. Remove the fuse holder. Place the new fuse into the fuse holder.

For knob-type fuse holders:

1. Push the fuse holder in with your fingers and turn 90° counterclockwise.
2. Remove the fuse holder. Place the new fuse into the fuse holder.

1. Disconnect the warming unit from the power source.
2. Remove the service lid and filter from the unit.
3. Remove the Phillips-head screws from the power head.
4. Flip the power head open towards the front of the unit and remove the Phillips-head screws from the lower filter seat.
5. To access the control board, remove the lower filter seat. If the filter seat is one piece, remove the screws holding it in place.

Figure 5. Accessing the control board fuse

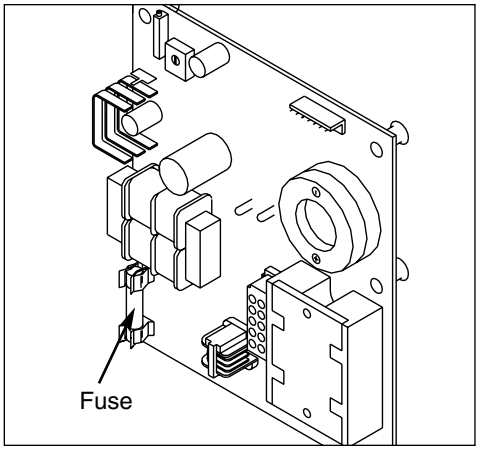


Replacing the fuses

Electrical shock hazard. *Dangerous voltages are present on the control board. Please use caution.*

1. Replace the fuse with the same type.
2. Reattach the lower filter seat.
3. Reattach the power head.
4. Reattach the filter (make sure the interlock switch is engaged) and reattach the service lid.

Figure 6. Watlow A007 control board



Air Filter Replacement

Tools/Equipment

Phillips-head screwdriver

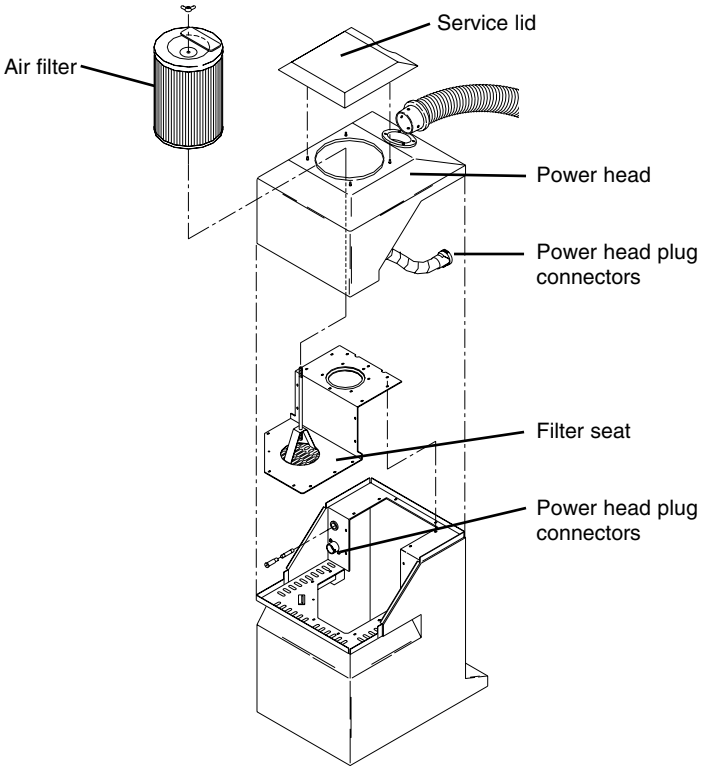
Service Frequency

Six-month intervals, or 500 hours of use

Method

1. Disconnect the warming unit from the power source.
2. Remove the service lid by lifting it up. Remove the wing nut from the top of the filter.
3. Remove the old filter.
4. Record the hour meter reading and date on the new air filter label.
5. Install the new filter. Make sure that the filter is seated firmly to fully engage the interlock switch.
6. Replace the wing nut and the service lid.
7. Connect the warming unit to the power source and turn it ON to verify that the filter interlock is properly seated.

Figure 7. Replacing the Air Filter



Over Heat Alarm Testing

WARNING: *Perform all testing and adjustments of warming unit temperature with a calibrated Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit. Augustine Medical, Inc. assumes no responsibility for the reliability, safety, or performance of the Bair Hugger System if warming unit temperature testing or adjustments are made in any other manner than that described here. Improper measurement or adjustment of the warming unit's over heat alarm setting could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

NOTE: *The Model 221 Temperature Test Kit and the Model 22110 Temperature Test Unit are designed to simulate the operating characteristics of Bair Hugger blankets when used with Bair Hugger warming units; use of the temperature test device with any other warming system may result in imprecise readings.*

If using the Model 221 Test Kit, temperature readings are taken from the test kit itself. If using the Model 22110 Test Unit, temperature readings are taken from a calibrated temperature meter.

Service Frequency

Six-month intervals, or 500 hours of use

Tools/Equipment

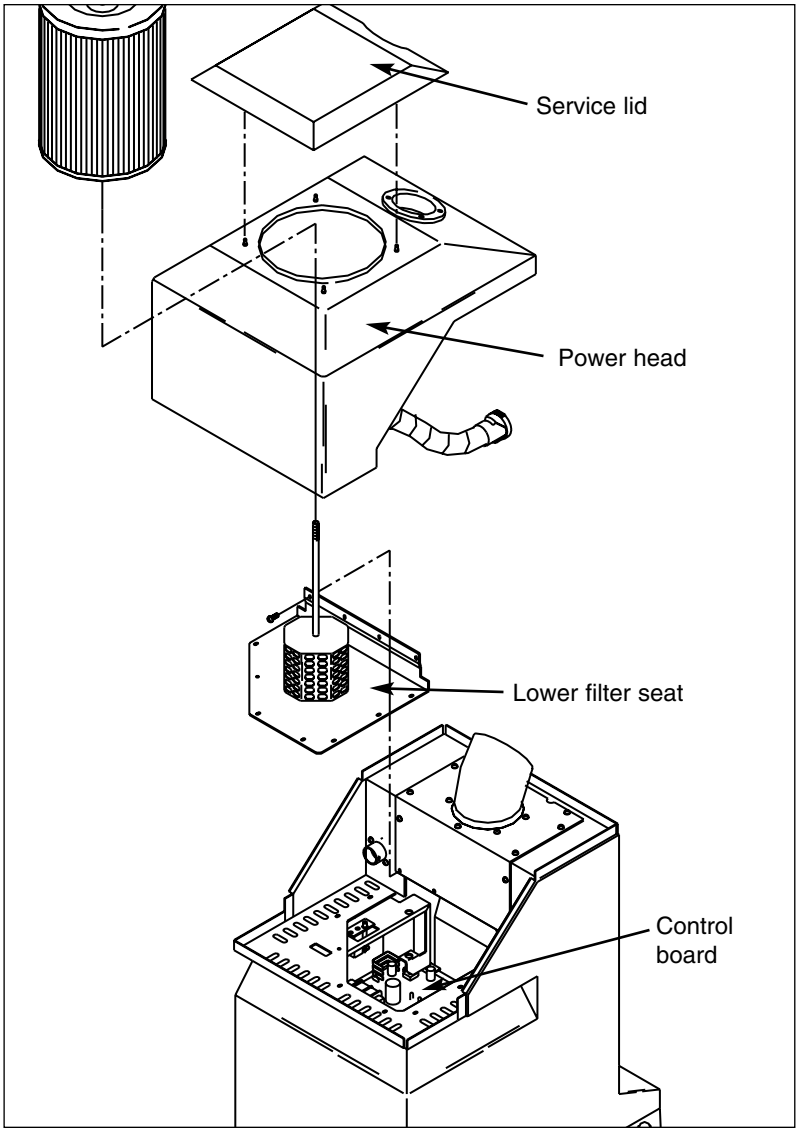
- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit
- Phillips-head screwdriver
- Short jumper wire with alligator clips or needlenose pliers

If using the Model 22110 Temperature Test Unit:

- Use a calibrated temperature meter that can accept a male subminiature connector for a K style thermocouple (e.g., a Fluke Model 52 K/J Thermometer).
- If the connector does not fit your meter, you can remove the provided connector and attach a connector that fits your meter.

1. Disconnect the warming unit from the power source.
2. Remove the service lid and filter from the unit.
3. Remove the Phillips-head screws from the power head.
4. Flip the power head open towards the front of the unit and remove the Phillips-head screws from the lower filter seat.
5. To access the control board, remove the lower filter seat. If the filter seat is one piece, remove the screws holding it in place

Figure 8. Accessing the Control Board



For units with a Watlow-manufactured board (A007 control board)

1. Attach a jumper wire from TP3 to TP4 to place the unit into over temperature mode. See Figure 9.
2. Replace the lower filter seat and reseat the power head on the unit. Do not attach any screws yet.
3. Reconnect the unit's hose and insert the open hose end in the port on the temperature test device.
4. Place the filter in the unit to engage the interlock switch, reconnect the unit to the power source, and turn the unit ON.
5. When the visual and audible alarms activate, note the temperature read-out. See Table 1 for specified limits.

   NOTE: *If the unit is out of specified limits go to the section* ***Over Heat Alarm Adjustment.***
6. After verifying the over temperature setpoint, disconnect the unit from the power source. Remove the jumper wire from TP3 and TP4.
7. Replace the filter seat and reassemble the power head.
8. Replace the filter. Make sure the interlock switch and the service lid are engaged.

Table 1. Over heat specification

Model 500 High Temperature Thermostat
The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 50°C to 56°C (122°F to 132°F) at the end of a hose, as determined by the Augustine Medical temperature test device.

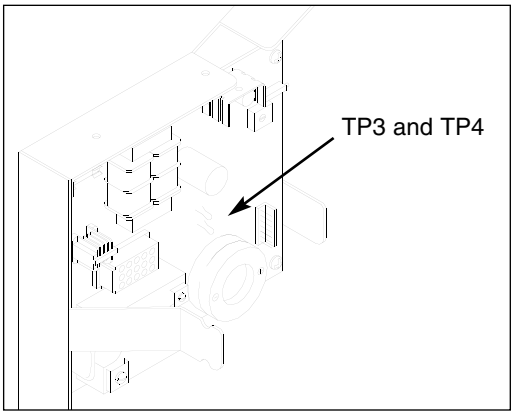


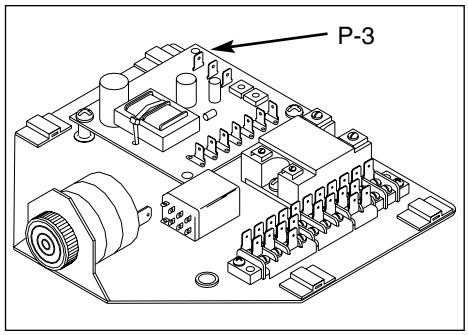
Figure 9. Locating TP3 and TP4 on the Watlow A007 control board

For units with the Series 80 control board

1. Carefully lift up the filter seat by lifting up on the edge near the hour meter. **NOTE:** It is not possible to remove the filter seat completely because the interlock switch wires are still connected to the filter seat. Lift the filter seat just enough to clear the exhaust tube.
2. Lay the filter seat on the hour meter shelf, leaving the interlock switch wires connected.
3. Locate the Blue wire that connects to P-3 on the control board. (See Figure 10.) Carefully disconnect this wire from P-3.
4. Replace the filter seat. Do not secure the filter seat at this point.
5. Reseat the power head on the unit. Do not attach the screws yet.
6. Place the filter in the unit to engage the interlock switch.
7. Reconnect the warming unit hose, connect the hose to the port on the temperature test device, and reconnect the unit to the power source.
8. Turn the warming unit ON and wait for the audible or visual alarm to activate. When the alarm activates, note the temperature read-out. See Table 1 for specified limits.

   NOTE: *If the unit is out of specified limits, go to the section* ***Over Heat Alarm Adjustment.***
9. After verifying the over heat alarm, unplug the warming unit and reconnect P-3 on the control board.
10. Replace the filter seat and reassemble the power head.
11. Replace the filter. Make sure the interlock switch and the service lid are engaged.

Figure 10. Locating P-3 on the Series 80 control board



Over Heat Alarm Thermostat Adjustment

WARNING: *Improper adjustment of the warming unit's over heat alarm set point could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

- *Closely follow instructions for thermostat adjustment.*

- *Dangerous voltages are present at the terminals of the thermostat.*
- *Always use a Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit to verify output temperatures.*
- *Recalibrate the Temperature Test Kit at least once a year. The Model 22110 Temperature Test Unit does not need to be calibrated. The meter it is connected to must be calibrated. Follow the calibration instructions in the meter service manual or follow standard facility calibration schedules.*
- *When in doubt, contact Technical Service for assistance in temperature adjustment.*

Tools/Equipment

- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit
- Small slotted screwdriver
- Phillips-head screwdriver
- Short jumper wire with alligator clips or needlenose pliers

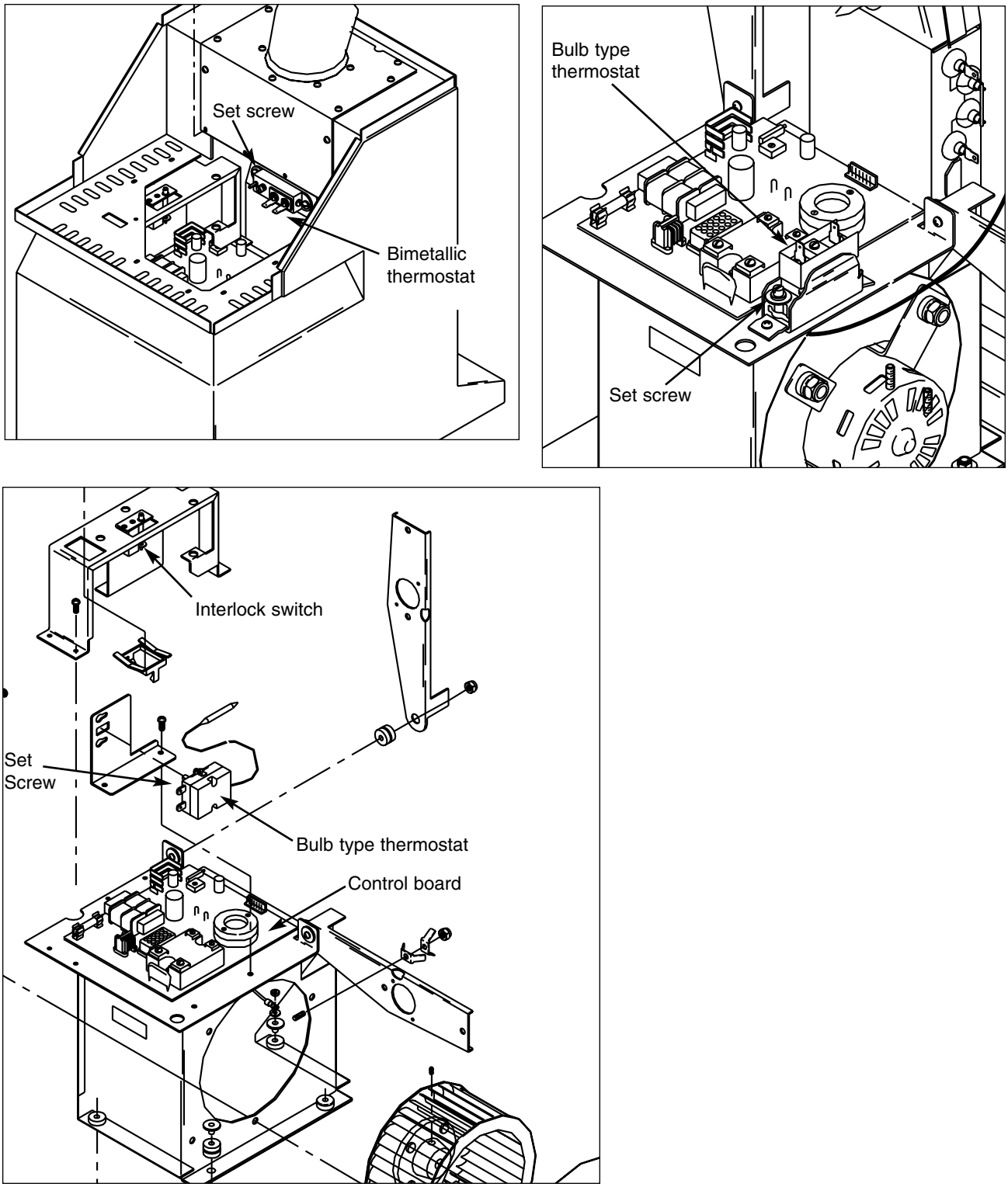
If using a Model 22110 Temperature Test Unit:

- Use a calibrated temperature meter that can accept a male subminiature connector and that can read a K style thermocouple (e.g., a Fluke Model 52 K/J Thermometer).
- If the connector does not fit your meter, you can remove the provided connector and attach a connector that fits your meter.

Adjusting the Over Heat Alarm Thermostat

1. Locate the over heat adjustment thermostat (see Figure 11).

Figure 11. Location of Thermostat in Model 500 Units



2. Use a small slotted screwdriver to adjust the thermostat.
   - If the tested alarm temperature was **below** the specified limits, turn the screwdriver CLOCKWISE to increase the alarm temperature.
   - If the tested alarm temperature was **above** specified limits, turn the screwdriver COUNTERCLOCKWISE to lower the alarm temperature.
3. Fine-tune the adjustment until the warming unit alarms at the specified temperature.
4. When the over heat alarm activates both visually and audibly, note the maximum temperature achieved. As the unit cools down, it will eventually reset and then over heat again. The alarm and automatic reset constitutes one cycle.
5. Retest the alarm temperature to verify correct adjustment at least two (2) times. Allow the warming unit to cycle before each test.
6. When the warming unit alarm setting is within the specified limit, turn the warming unit OFF, and disconnect it from the power source.
7. Remove the hose end from the port on the temperature test device.
8. Remove the jumper wire from between the test points, (or reattach the P3 lead, if applicable).
9. Replace the filter seat and reassemble the power head.
10. Replace the filter (make sure the interlock switch is engaged) and the service lid.
11. Record the maintenance action taken.

Normal Operating Temperature Testing

WARNING: *Perform all testing and adjustments of warming unit temperature with a calibrated Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit. Augustine Medical, Inc. assumes no responsibility for the reliability, safety, or performance of the Bair Hugger system if warming unit temperature testing or adjustments are made in any other manner than that described here. Improper measurement or adjustment of the warming unit's normal operating temperature could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

NOTE: *The Model 221 Temperature Test Kit and the Model 22110 Temperature Test Unit are designed to simulate the operating characteristics of Bair Hugger blankets when used with Bair Hugger warming units; use of the temperature test device with any other warming system may result in imprecise readings.*

Service Frequency

Six-month intervals, or 500 hours of use

Tools/Equipment

Model 221 Temperature Test Kit or the Model 22110 Temperature Test Unit

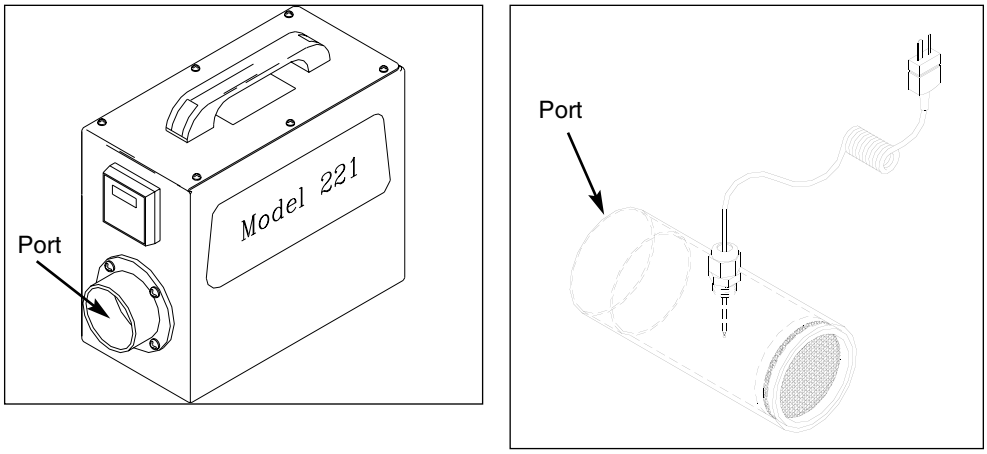
Method

1. Insert the open hose end from the warming unit in the port on the temperature test device (see Figure 12).

   NOTE: *Do not block the rear air vents on the test device.*

2. Turn the warming unit power ON and select the HIGH temperature setting. Always begin testing with the HIGH setting.
3. Note the ambient room temperature.
4. After approximately five (5) minutes of operation, note the temperature read-out. Use Figure 14 to correlate ambient temperature to the warming unit's operating temperature.

Figure 12. Temperature Test Units



5. After correcting for ambient temperature, the tested normal operating temperature should meet the limits specified in Figure 13.
6. If the HIGH temperature setting is not within specified limits, adjust the normal operating temperature. See the Normal Operating Temperature Adjustment section.

Table 2.
Model 500 Operating Temperatures

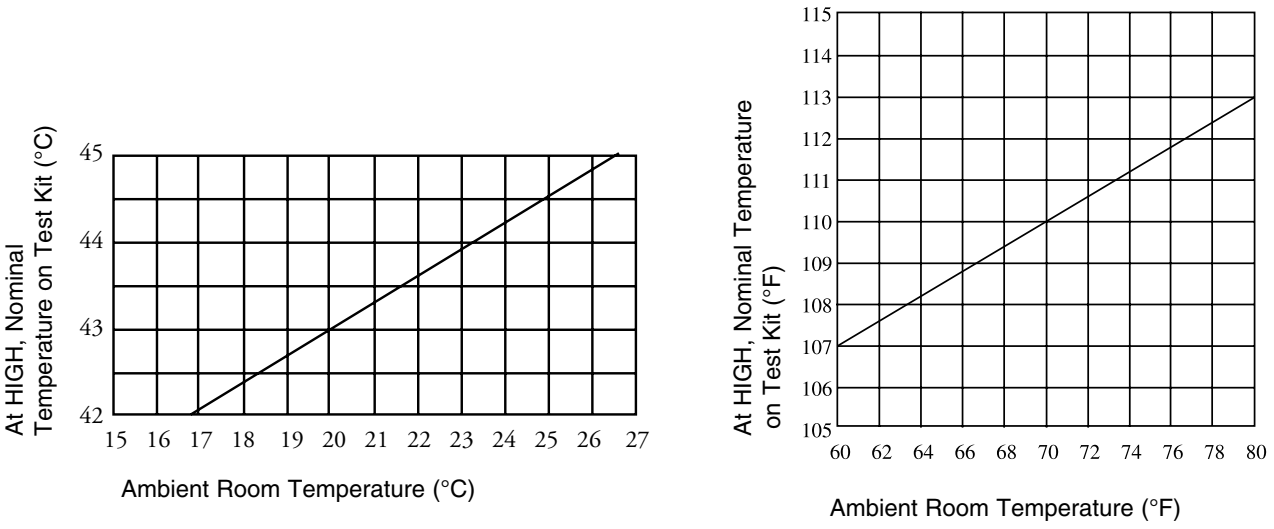
(Operating temperatures= Average temperature at the end of the hose.)

Operating Temperatures		
HIGH:	43°± 3°C	109° ± 5.4°F
MED:	38°± 3°C	100° ± 5.4°F
LOW:	32°± 3°C	90° ± 5.4°F

Note: Air temperature reaching the patient is approximately 2°C lower than the temperatures listed.

7. If the HIGH temperature setting is within specified limits, verify the MED, and then LOW settings against specified limits (allow the warming unit to operate at each temperature setting for about three (3) to five (5) minutes before each test).
8. Turn the warming unit OFF. Remove the hose end from the port on the temperature test device.
9. Record the maintenance action taken.

Figure 13. Room Temperature v.s. High Temperature Output
Warming unit temperature setting should be on HIGH when conducting this test



Normal Operating Temperature Adjustment

WARNING: *Improper adjustment of the warming unit's normal operating temperature could result in patient exposure to temperatures outside of the indicated range, and may lead to patient injury.*

- *Closely follow instructions for temperature adjustment.*
- *Always use a Model 221 Temperature Test Kit or a Model 22110 Temperature Test Unit to verify output temperatures.*
- *Always make adjustments relative to the HIGH temperature setting on the warming unit. When the HIGH setting is accurately adjusted, the MED and LOW settings should also be within specified limits. If the HIGH range is properly set, and MED and/or LOW do not meet specs, call AMI Technical Service.*
- *Recalibrate the Temperature Test Kit at least once a year. The Model 22110 Temperature Test Unit does not need to be calibrated. The meter it is connected to must be calibrated. Follow the calibration instructions in the meter service manual or follow standard facility calibration schedules.*
- *When in doubt, contact AMI Technical Service for assistance in temperature adjustment.*

Tools/Equipment

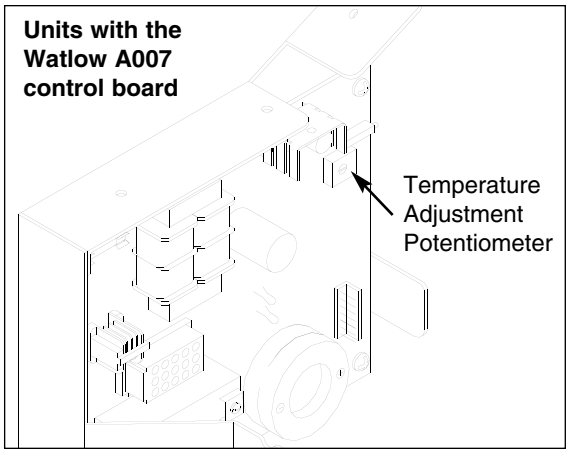
- Phillips-head screwdriver
- Small slotted screwdriver
- Model 221 Temperature Test Kit or Model 22110 Temperature Test Unit

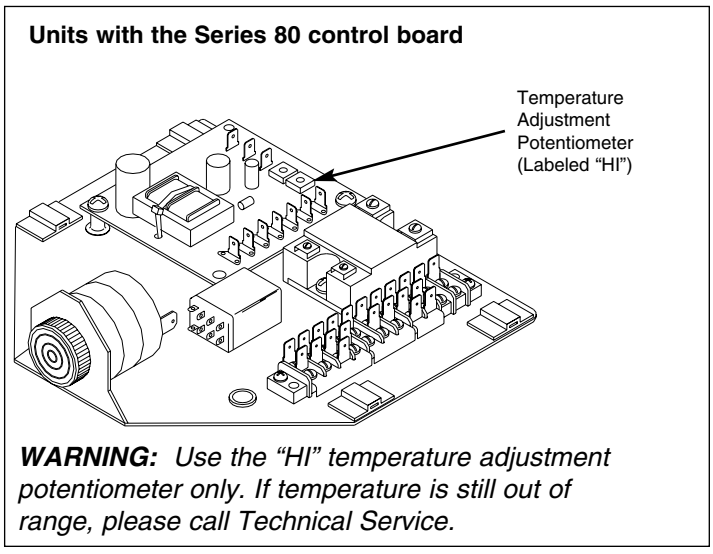
Method

The temperature adjustment potentiometer is located on the warming unit's control board (see Figure 14).

Electrical shock hazard. *Dangerous voltages are present on the control board. Please use caution.*

Figure 14. Location of the Temperature Adjustment Potentiometer





1. Disconnect the warming unit from the power source.
2. Remove the service lid and filter from the unit.
3. Remove the fourteen (14) Phillips-head screws from the power head.
4. Flip the power head open towards the front of the unit and remove the Phillips-head screws from the lower filter bracket.
5. Carefully lift up the filter seat by lifting up on the edge near the hour meter. **NOTE:** For units with a one-piece filter seat: It is not possible to remove the filter seat completely because the interlock switch wires are still connected to the filter seat. Lift the filter seat just enough to clear the exhaust tube.
6. Find the high temperature adjustment potentiometer. See Figure 15.
7. Replace the filter seat and powerhead. Do not secure either one at this point.
8. Place the filter in the unit to engage the interlock switch.
9. Insert the open hose end from the warming unit into the port on the temperature test device.

   NOTE: *Do not block the rear air vents on the test device.*

10. Turn the warming unit power ON, and select the HIGH temperature setting. Always make adjustments relative to the HIGH setting.
11. After approximately five (5) minutes of operation, adjust the potentiometer.
    - If the tested operating temperature was below specified limits, turn the screwdriver CLOCKWISE to increase the operating temperature.
    - If the tested operating temperature was above specified limits, turn the screwdriver COUNTERCLOCKWISE to lower the operating temperature.

12. Adjust the potentiometer until the read-out meets the limits specified in Table 2 for the HIGH temperature setting (correlated to ambient temperature as in Figure 13).
13. Verify that the MED and LOW temperature settings are also within specified limits. If the HIGH range is properly set, and MED and/or LOW do not meet specs, call Augustine Medical Customer Service.
14. Turn the warming unit power OFF, and remove the hose from the port on the temperature test device.
15. Disconnect the warming unit from the power source.
16. Reattach the filter seat and power head with the appropriate number of screws.
17. Replace the filter and service lid.
18. Record the maintenance action taken.

Specifications

Physical Characteristics

Dimensions 25.5 in. high x 14 in. deep x 15 in. wide;

65 cm high x 36 cm deep x 38 cm wide

Weight 45 lb (20.3 kg)

Safety System

Thermostat

Bulb and capillary type or bi-metallic type

Over Heat Warning

If the temperature gets too high, the Over Heat Warning light on the front panel will illuminate and the alarm will sound. The heat will shut off and the blower will continue to run.

High Temperature Thermostat

The thermostat interrupts power to the heater and activates the alarm at a preset high temperature of 53°C ±3° (122°F to 132°F), at the end of the hose, as determined by an Augustine Medical, Inc. temperature test device.

Temperature Characteristics

Air temperatures reaching the patient are approximately 2°C lower than the listed temperatures.

Operating Temperatures

Average temperature at the end of the hose, assuming the back pressure of a Bair Hugger blanket, or an Augustine Medical, Inc. Model 221 Temperature Test Kit or the Model 22110 Temperature Test Unit.

HIGH:	43.1° ± 3°C	110° ± 5°F
MED:	37.8° ± 3°C	100° ± 5°F
LOW:	33.9° ± 5°C	90° ± 5°F

Electrical Characteristics

Leakage Current

Meets hospital and regulatory standards for leakage current.

Motor

1/30 horsepower, single phase
3600 rpm Motor

Heater

850 W sealed heating element

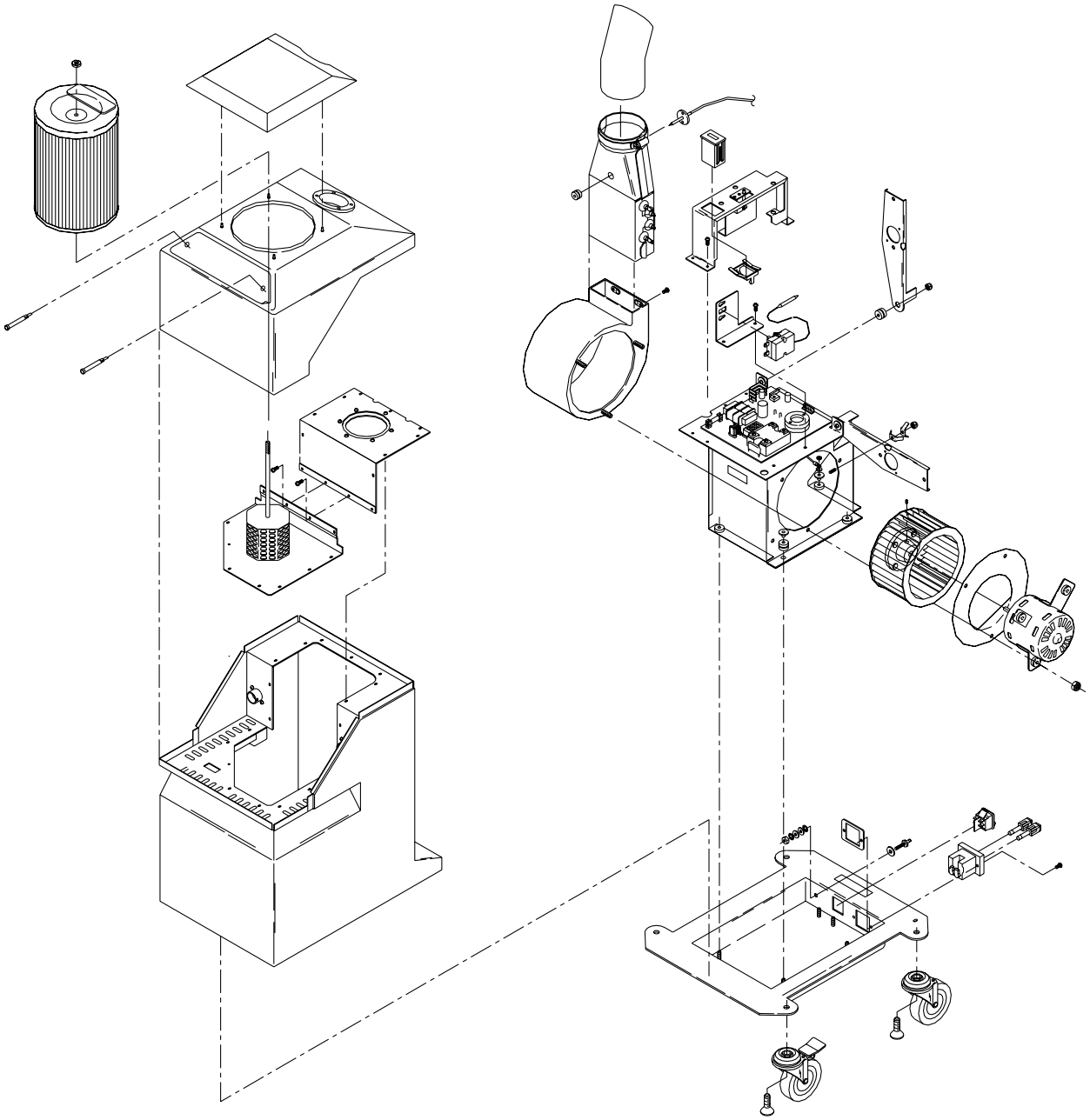
Fuses

250V, 15A or 10A and .062 Amp Slo Blo
or
(2) 250V 10A and .063A

Device Ratings

115V, 60Hz, 8.5 Amperes
240VAC, 50Hz, 4.5 Amperes
100VAC, 60Hz, 9.5 Amperes

Exploded View of Model 500 Unit



Appendix

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Returning Units for Service

1. Call Technical Service (see inside front cover for phone number) to get a Return Authorization (RA) number and a service carton.
2. Using a marking pen, write your Return Authorization number on the outside of the carton.

Troubleshooting

Problem	Possible Cause	Solution
Warming unit will not power up	Some units have an additional on/off switch near cord attachment—this might be off	Turn switch on
	Line fuses are blown	Replace line fuses
	Poor/loose wire connections	• Check connection at power entry module (if so equipped) • Ensure that connectors at the control unit board and/or terminal bar are intact
	No power at outlet	Check power at the outlet
Warming unit circulates air but no heat	Poor/loose connections	Check connections to the control unit board and to the switch
Warming unit does not heat on all heat settings	Poor/loose connections	Check connections at the switch
Warming unit alarms upon startup	Open thermostat or poor/loose connections to the thermostat	Check thermostat circuit (black wires with yellow stripe and thermostat)
	Faulty alarm relay	Call Technical Service
Warming unit alarms at temperatures that are too high or too low	Operating temperatures are out of calibration	Recalibrate operating temperatures
	Thermostat is out of calibration	Recalibrate over temperature set point
	Faulty thermostat	Call Technical Service
Warming unit heats to alarm condition on all settings	Unit is in over temperature test mode	Ensure that P-3 is connected or that TP3 and TP4 are not shorted
	Thermostat is out of calibration	Recalibrate over temperature set point
	Runaway heat failure	Call Technical Service

Maintenance Log

Date	Maintenance Action Performed	Hour Meter	Serial No.

Augustine Medical
Bright ideas…that work

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Watlow is a registered trademark of Watlow Electric Manufacturing Company, St. Louis, MO.

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US 6,309,408; 6,309,409; 6,290,716; 6,287,327; 6,241,755; 6,228,107; 6,210,428; 6,203,567; 6,176,870; 6,168,612; 6,146,412; 6,126,681; 6,126,393; 6,129,936; 6,036,722; 5,997,572; 5,968,084; 5,964,792; 5,928,274; 5,824,025; 5,800,489; 5,773,275; 5,733,318; 5,697,963; 5,674,269; 5,658,325; 5,620,482; 5,545,194; 5,405,371; 5,350,417; 5,336,250; 5,324,320; 5,300,102; 5,300,101; 5,184,612; 5,044,364; 4,572,188; Japan 2,561,326; Canada 1,325,484; EPO 0311336. Other patents pending.

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